

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2320
Gaithersburg, Maryland 20899-2320

SRM Number: 3153a
MSDS Number: 3153a
SRM Name: Strontium Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of strontium. One unit of SRM 3153a consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of strontium. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Strontium Standard Solution

Other Designations:

Strontium: Sr; elemental strontium.

Strontium Nitrate: Strontium dinitrate; nitric acid, strontium salt.

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Strontium Nitrate	10042-76-9	233-131-9	2.4
Strontium	7440-24-6	231-133-4	1

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Strontium and strontium nitrate are primarily irritants, but chronic exposure may damage the heart or other organs.

Physical Hazards: Glass container may break or shatter.

Potential Health Effects

Inhalation:	Nitric acid can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Teeth may also be damaged. Inhalation of strontium or strontium nitrate may irritate the respiratory tract; high-level exposure may cause chemical pneumonia. See also Ingestion.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Skin contact with strontium may cause irritation. Strontium nitrate may cause severe burns.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Strontium may cause eye irritation. Strontium nitrate may cause blurred vision, pain, burns, and permanent eye damage.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Strontium and its compounds are poorly absorbed from the GI tract, but a large dose or chronic exposure may cause osmotic disturbances, nausea, vomiting, and diarrhea. In animal studies, chronic exposure to strontium has damaged the heart, lungs, liver, kidneys, blood-forming organs, and central nervous system. Strontium may accumulate in the bones and other organs, and its health effects may persist after exposure stops.

Medical Conditions Aggravated by Exposure: None documented for this mixture. Its components may aggravate disorders of the eyes, skin, respiratory tract, kidneys, nervous system, cardiovascular system, and/or blood. A diet low in calcium may increase the absorption of strontium.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO₂). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Nitric acid and strontium nitrate are both oxidizing agents that can react with combustible materials to cause fires. Strontium metal (not present in this mixture) may ignite spontaneously in air. No data are available for the mixture, and its behavior may differ from that of the individual components.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place with acid-resistant flooring at room temperature. Protect from physical damage, water, humidity, heat, direct sunlight, and incompatible materials.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m³

OSHA TLV-TWA: 2 ppm or 5 mg/m³

UK WEL: 5.2 mg/m³

Strontium Nitrate

OSHA TLV-TWA: None established. Total nuisance dust, 15 mg/m³; respirable dust, 5 mg/m³

ACGIH TLV-TWA: None established. Total nuisance dust, 10 mg/m³; respirable dust, 3 mg/m³

UK WEL: None established. Total inhalable dust, 10 mg/m³; respirable dust, 4 mg/m³

Strontium

OSHA TLV-TWA: None established. Total nuisance dust, 15 mg/m³; respirable dust, 5 mg/m³

ACGIH TLV-TWA: None established. Total nuisance dust, 10 mg/m³; respirable dust, 3 mg/m³

UK WEL: None established. Total inhalable dust, 10 mg/m³; respirable dust, 4 mg/m³

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Strontium Nitrate	Strontium
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Colorless or white crystalline powder	Appearance and Odor: Silvery white metal
Relative Molecular Weight: 63.02	Relative Molecular Weight: 211.63	Relative Molecular Weight: 87.62
Molecular Formula: HNO ₃	Molecular Formula: Sr(NO ₃) ₂	Molecular Formula: Sr
Specific Gravity: 1.0543 (10%)	Specific Gravity: 2.986	Specific Gravity: 2.6
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Very soluble in liquid ammonia	Solvent Solubility: Soluble in dilute acids
Water Solubility: Soluble	Water Solubility: Soluble	Water Solubility: Reacts with water
Boiling Point (°C): 86 (187°F)	Boiling Point (°C): 645 (1193°F)	Boiling Point (°C): 1384 (2523°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): N/A	Vapor Pressure (Pa): 246 @ 1042°K
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A	Vapor Density (Air=1): N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this solution do not exist. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: ☒ Stable ☐ Unstable

Stable at normal temperatures and pressure

Conditions to Avoid: Mechanical damage, static discharge, dust generation, heat, flame, friction, contact with incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Strontium Nitrate: Incompatible with reducing agents, organic compounds, and halogens.

Strontium: Incompatible with strong oxidizers.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of this material may produce nitrogen oxides, strontium oxide, strontium nitride, and other products.

Hazardous Polymerization: ☐ Will Occur ☒ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: ☒ Inhalation ☒ Skin ☒ Ingestion

Nitric Acid:

Human, oral: $LD_{Lo} = 430 \text{ mg/kg}$

Rat, oral: $LD_{50} > 90 \text{ mg/kg}$

Rat, inhalation: $LC_{50} (4 \text{ hrs}) = 130 \text{ mg/m}^3$

Strontium Nitrate:

Rat, oral: $LD_{50} = 27500 \text{ mg/kg}$

Rat, intraperitoneal: $LD_{50} = 540 \text{ mg/kg}$

Mouse, oral: $LD_{50} = 1826 \text{ mg/kg}$

Strontium:

Rat, oral: NOAEL = 263 mg/kg-day

(Toxic dose depends on dietary calcium)

Target Organ(s): Skin, eyes, respiratory tract, GI tract, central nervous system, blood, kidneys, liver, heart.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Strontium and strontium nitrate are not classified as mutagens or teratogens.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): $LC_{50} (48 \text{ hrs}) = 180,000 \text{ } \mu\text{g/L}$

Starfish (*Asterias rubens*): $LC_{50} (48 \text{ hrs}) = 100,000 \text{ to } 330,000 \text{ } \mu\text{g/L}$

Hooknose (*Agonus cataphractus*): $LC_{50} (48 \text{ hrs}) = 100,000 \text{ to } 330,000 \text{ } \mu\text{g/L}$

Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 $\mu\text{g/L}$

Cockle (*Cerastoderma edule*): $LC_{50} (48 \text{ hrs}) = 330,000 \text{ to } 1,000,000 \text{ } \mu\text{g/L}$

Strontium Nitrate: No ecotoxicity data found.

Strontium: No ecotoxicity data found.

Environmental Summary: The ecological effects of this mixture have not been fully evaluated. Do not release to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture are a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Nitric Acid Solution, Hazard Class 8, UN2031, Packing Group II

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Strontium Nitrate: Not regulated

Strontium: Not regulated

SARA Title III Section 302: Nitric acid is regulated

SARA Title III Section 304: Nitric acid is regulated

SARA Title III Section 313: Nitric acid and strontium nitrate (N511, Nitrate Compounds) are regulated.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

STATE REGULATIONS

California Proposition 65: No components are regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Strontium Nitrate: C (oxidizing material)

Strontium: D2B (toxic material)

WHMIS Ingredient Disclosure List: Nitric acid is regulated (1%)

CEPA Domestic Substances List (DSL): All three components are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Strontium Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Strontium: Xn (Harmful); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Risk Phrases (mixture):

R23 (toxic by inhalation)
R25 (toxic if swallowed)
R34 (causes burns)
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

16. OTHER INFORMATION

Sources:

New Jersey Department of Health and Senior Services, Hazardous Substance Fact Sheet: Strontium Nitrate. March 2000.

PAN Pesticide Database: Nitric Acid.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, September 2005 edition. DHHS (NIOSH) Publication No. 2005-151.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.